LD5 Installation

Manual

VERIPOS

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1. INTRODUCTION

1.1 GENERAL

This document provides the information required to install a VERIPOS LD5 IMU.

When consulting this document it will help the installer to have available the following items to assist in assessing and planning the work:

- VERIPOS LD5 and associated equipment shipped to site
- 'Equipment Packing list' (included with the equipment packing sent to site)
- LD5 Operations manual
- VERIPOS document "Antenna and Coaxial Cable Installation" provided with VERIPOS installation documentation
- Interactive training modules and VERIPOS product literature available at http://help.veripos.com.

1.2 LD5 INTEGRATED MOBILE

The VERIPOS LD5 IMU is easy to install and operate. It is an effective, flexible unit that ensures reliable reception of VERIPOS services with superior positioning from metre to decimetre level accuracy.

It is designed as a standardised, upgradeable L-band receiver that is simple to operate and maintain.

The LD5 can be upgraded as required to generate VERIPOS proprietary position solution depending on the data subscriptions enabled.

LD5 variants may be used as a sensor to output received data and GNSS measurements to external processing or quality control software such as the VERIPOS QC.

The LD5 has a 3.5" (9 cm) colour screen that allows quick and easy user setup.

The LD5 is extremely flexible. Operating status is determined using the front panel display.

1.3 SCOPE

The purpose of this manual is to provide the necessary information to perform the installation of the VERIPOS LD5 Integrated Mobile Unit.

It covers installation of:

- Antennas
- Coaxial and data cables
- LD5 receiver and power requirement
- Housings and ancillary equipment provided with the LD5.

1.3.1 Contents

This manual provides guidance for engineers to install a VERIPOS LD5 receiver on to a vessel.

Details are provided to assist in locating and connecting equipment ready to be commissioned.

Read this manual in conjunction with the specific ‘Scope of Supply’ or Equipment Packing List’ for your particular installation.

Chapter Contents

1. Introduction - This chapter specifies the purpose and target group for the manual. It also contains a list of used abbreviations and a specification of the document conventions.

2. System description - This chapter describes the interface in detail on the front and back side of the LD5 unit as well as LD5 technical data.

3. Installation - This chapter covers the installation of the LD5 unit as well as cabling guidelines.

4. Reference information - This chapter comprise additional information such as Safety check list, cable specifications, parts list and a description of LD5.

5. Contact information - This chapter contains contact information details about the VERIPOS Helpdesk and VERIPOS offices world-wide.

1.4 TERMS AND ABBREVIATIONS

Apex	A VERIPOS High accuracy PPP positioning system using GPS
Apex²	A VERIPOS High accuracy PPP positioning system using GPS and GLONASS
BER	Bit Error Rate
CoG	Course over Ground
CR	Carriage Return
DGPS	Differential GPS
DGNSS	Differential GNSS
DOP	Dilution of Precision
DP	Dynamic Positioning
EGNOS	European Geostationary Navigation Overlay System
GDOP	Geometry Dilution of Precision
GLONASS	GLObal NAvigation Satellite System – Russian equivalent to GPS
GPS	Global Positioning System
GNSS	Global Navigation Satellite System
HDOP	Horizontal Dilution of Precision
IMU	Integrated Mobile Unit
KPH	Kilometres per Hour
LAN	Local Area Network
LF	Line Feed
LNA	Low Noise Amplifier
L-Band	A radio frequency band used to transmit correction data to mobile users
LCD	Liquid Crystal Display
LD5	A VERIPOS unit available with GNSS, Demodulator and Beacon cards
LVTTL	Low Voltage Transistor Transistor Logic
MF	Medium Frequency band used to transmit IALA Beacon Correction Data
MMI	Man Machine Interface
MPH	Miles per Hour
m/s	Metres per Second
MSAS	Multi-functional Satellite Augmentation System
NMEA	National Marine Electronics Association
PDOP	Positional Dilution of Precision
PPP	Precise Point Positioning
PPS	Pulse per Second
PRN	Pseudo Random Noise
RMS	Root Mean Square
RTCM	Radio Technical Commission for Maritime Services
SBAS	Satellite Based Augmentation System
SD	Standard Deviation

SDRAM	Synchronous Dynamic Random Access Memory
SNF	Signal Notification Form
SNR	Signal to Noise Ratio
Spotbeam	High Power L-Band Signal
Standard (Std)	VERIPOS Single frequency (L1) DGPS system
Standard² (Std²)	VERIPOS Single frequency (L1) DGNSS system (GPS + GLONASS)
SV	Space Vehicle
Ultra	A VERIPOS High accuracy PPP positioning systems using GPS
Ultra²	A VERIPOS High accuracy PPP positioning system using GPS and GLONASS
USB	Universal Serial Bus
UTC	Coordinated Universal Time
VDOP	Vertical Dilution of Precision
VGA	Video Graphic Array
VOSS	VERIPOS Online Support System
WAAS	Wide Area Augmentation System
WEEE	Waste Electrical and Electronic Equipment

1.5 LD5 SAFETY SUMMARY

This section summarizes safety guidelines when installing the LD5 unit.

1.5.1 Unpacking and inspection

Carefully unpack the unit and retain packaging to return the equipment where required.

Inspect the unit. If the equipment appears damaged return it using the original packaging. Responsibility for damage is not accepted if the approved packaging is not used.

Ensure all items and ancillary equipment is present. Contact your supplier or VERIPOS where this is not the case (see contacts in the Contact information chapter).

1.5.2 Safety symbols

Please see section 1.6 *Document conventions* later in this manual.

1.5.3 Safety warnings

Always observe the following safety precautions:

- Disconnect power from power supply to isolate the equipment before working on it.
- Ensure adequate air circulation to ventilate the unit especially to the sides to avoid heat build-up.
- ***The LD5 unit is class 1 construction and must be grounded***.
- Connect only to a power supply with a voltage corresponding to that marked on the unit.
- ***Always*** disconnect the LD5 and associated equipment from the power supply when connecting equipment.
- The equipment is for use in moderate climates only. Never use the equipment in damp or wet conditions.
- Avoid excessive heat, humidity, dust and vibration.
- Do not use where the equipment may be subjected to dripping or splashing liquids.
- Always use the power connections supplied with the unit. See the *Reference information* chapter for details.
- Before replacing a fuse, ***disconnect the equipment from power supply***.

1.5.4 Installation

Ensure the DC power supply is disconnected during installation. The power connection is easily accessed on the rear of the unit.

Ensure that the unit is secured using the holes in the base plate. Position the unit to ensure there is ample spacing for ventilation of the unit and access to front and rear during normal operation.

Ensure all cables are routed safely to avoid sharp edges, bends and pinches.

Ensure only the specified cables are used for interconnection of the equipment.

Permanently connect the vessels' protective earth to the protective bonding connection on the unit.

1.5.5 Maintenance

Clean the unit using a clean dry cloth only. Do not wet the unit or allow moisture to penetrate the unit. Do not use solvents to clean the unit.

1.5.6 Servicing

This unit contains no user-serviceable parts. Please refer all repairs to a qualified service agent or to VERIPOS.

See the *Reference information* chapter for details.

1.5.7 Fault diagnosis

Follow the guidance in this document to correctly install the LD5. Where the LD5 does not perform as indicated please first check all connections before contacting your supplier or VERIPOS for assistance (contact details in the *Contact information* chapter).

1.6 DOCUMENT CONVENTIONS

1.6.1 Typographical conventions

Italic or **bold** text is used to emphasize certain parts of the information. *Italic* is also used in cross-references to other parts of the document.

Bold text is also used for indicators and touch screen “push-buttons” commands.

“Text within quotes” is used when display screens are mentioned in text.

Monospace text is used for input/output strings to/from the device.

1.6.2 Special Notices

WARNING

A warning indicates the risk of bodily harm or serious damage to the hardware.

CAUTION

A caution indicates the risk of damaging the hardware.

NOTE

A note shows important information that helps you make better use of the system.

1.7 REFERENCES

Please read this manual and refer to the following information where required:

- VERIPOS document “Antenna & Coaxial Cable Installation”.
- LD5 Operations manual
- LD5 Quick Guide.

Information is available at VERIPOS Online support system (VOSS):
http://help.veripos.com

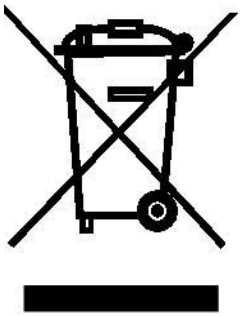
1.8 WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT

The Waste Electrical and Electronic Equipment Directive (hereinafter referred to as the “WEEE directive”) places an obligation on EU-based manufacturers, distributors, retailers and importers to take-back electronics products at the end of their useful life. A sister directive, RoHS (Restriction of Hazardous Substances) complements the WEEE directive by banning the presence of specific hazardous substances in the products at the design phase. The WEEE directive covers all VERIPOS products imported into the EU as of August 13, 2005. EU-based manufacturers, distributors, retailers and importers are obliged to finance the costs of recovery from municipal collection points, reuse, and recycling of specified percentages per the requirements contained in the WEEE Directive.

Instructions for disposal of WEEE by users in the European Union.

Products which have the undernoted symbol located on either the product itself or its packaging indicates that the product must not be disposed of with other waste. Instead, it is the user’s responsibility to dispose of the product by handing it over to a designated collection point for the recycling of WEEE. The symbol shown below is on the product or on its packaging, which indicates that this product must not be disposed of with other waste. Instead, it is the user’s responsibility to dispose of their waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment.

The separate collection and recycling of your WEEE at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about recycling centres, please contact the local city office, the household waste disposal service or the product supplier.



1.9 DISCLAIMER

VERIPOS accepts no responsibility for any damage or injury to the system, ship or personnel caused by drawings, instructions or procedures not prepared by VERIPOS.

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2. LD5 SYSTEM DESCRIPTION

This section gives an outline description of the VERIPOS LD5 IMU and components used with the unit.
The section covers:

- Equipment technical data
- Mechanical dimensions
- Electrical specification
- Processor
- GNSS Receiver*
- L-Band Receiver
- MF Beacon Receiver*
- Data interfaces including serial ports
- Antennas

* LD5 model supplied may optionally include these items.

2.1 LD5 RECEIVER

The VERIPOS LD5 receiver is a multi-purpose unit built on a modular design. A colour control panel is used to set up and display control and output information.

Figure 1. The VERIPOS LD5 Receiver

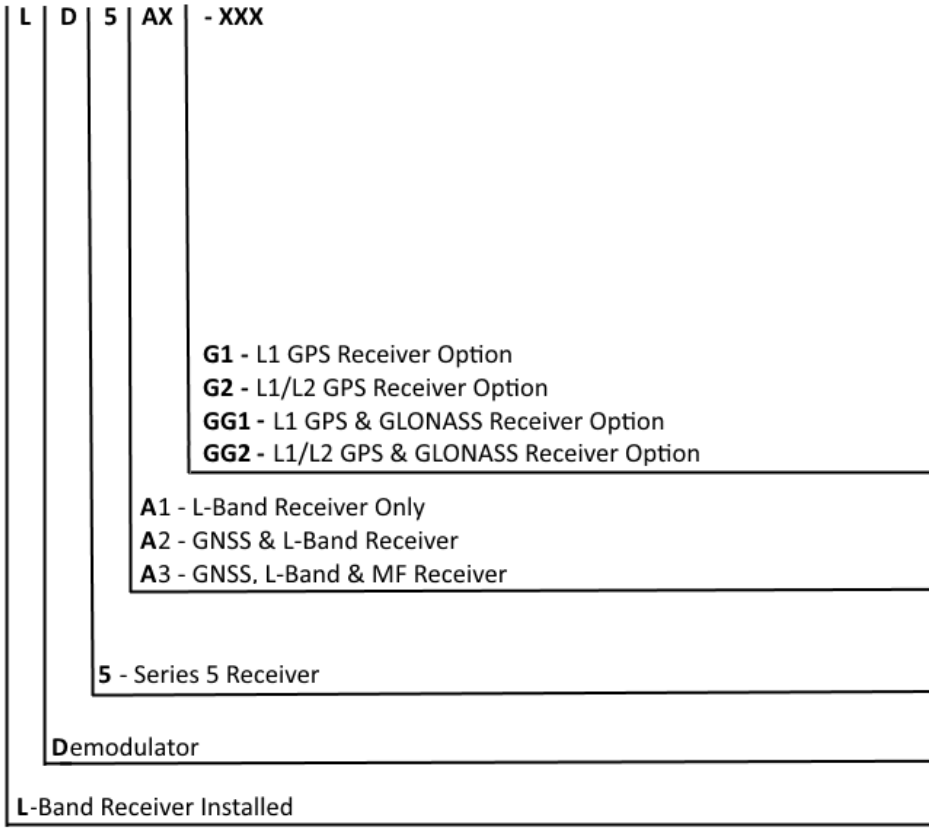
LD5 comprises:

- L-Band receiver
- Housing with external power supply
- Controller
- Interfaces for data output
- Display/control interface

Modules (optional):

- GNSS receiver
- MF receiver

2.1.1 Examples of LD5 variants


L D 5 AX - XXX
G1 - L1 GPS Receiver Option
G2 - L1/L2 GPS Receiver Option
GG1 - L1 GPS & GLONASS Receiver Option
GG2 - L1/L2 GPS & GLONASS Receiver Option
A1 - L-Band Receiver Only
A2 - GNSS & L-Band Receiver
A3 - GNSS, L-Band & MF Receiver
5 - Series 5 Receiver
Demodulator
L-Band Receiver Installed

In addition to the LD5 variants stated above, there are also various ‘Mod’ variants available which make it possible to use different antenna configuration if required.

The LD5 variants have controls for each fitted module – L-Band / GNSS / MF – for switching on or off the DC voltage to the attached antenna(s).

The following table details Module interface, antenna connections and voltage control.

LD5 Variant	N -Type Bulkhead	TNC Bulkhead
A1	*L-Band	N/A
A2	*L-Band / **GNSS**	N/A
A2 – Mod1	*L-Band	**GNSS
A3	*L-Band / **GNSS**	*MF
A3 – Mod 1	*L-Band / **MF**	**GNSS
A3 – Mod 2	*L-Band	**GNSS / MF

Key:

* = This module controls antenna voltage on / off

** = Power is always on from LD5

Bold Text = Power to this antenna function is controlled from LD5 module menu, marked with * in the same box on the table

2.1.2 Installation

Installation work for the LD5 varies for:

- The types of antenna(s) to be installed
- Connections for input of data to or output of positioning data from the LD5.

Installation is described in detail in chapter *3 Installation*. Examples are shown in Chapter 3 *Installation* to illustrate arrangement of typical installation of antennas and position output from the LD5.

2.2 CONTROLS, CONNECTORS AND I/O PORTS

2.2.1 Front Panel

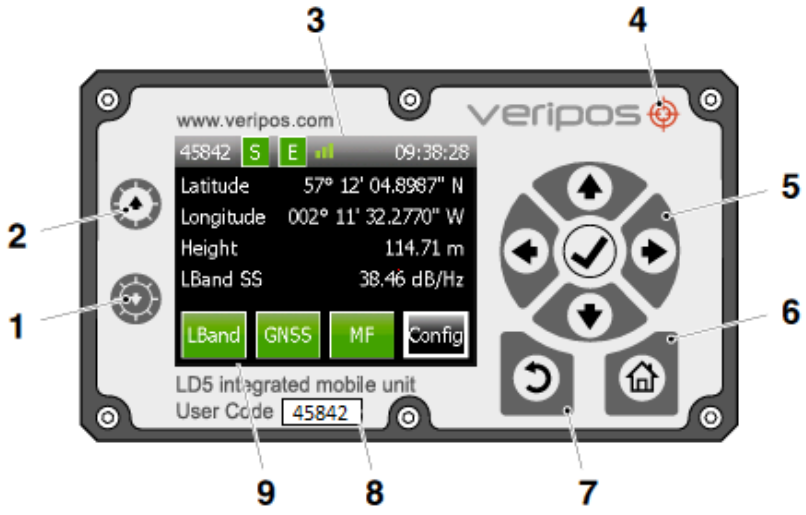


Figure 2.LD5 Front Panel

1	Adjust screen darker
2	Adjust screen lighter
3	L-Band Signal Strength Indicator
4	Power indicator
5	Navigation panel
6	Home
7	Return
8	User code (5 digits)
9	Receiver card icons (3 max)

2.2.2 Rear panel

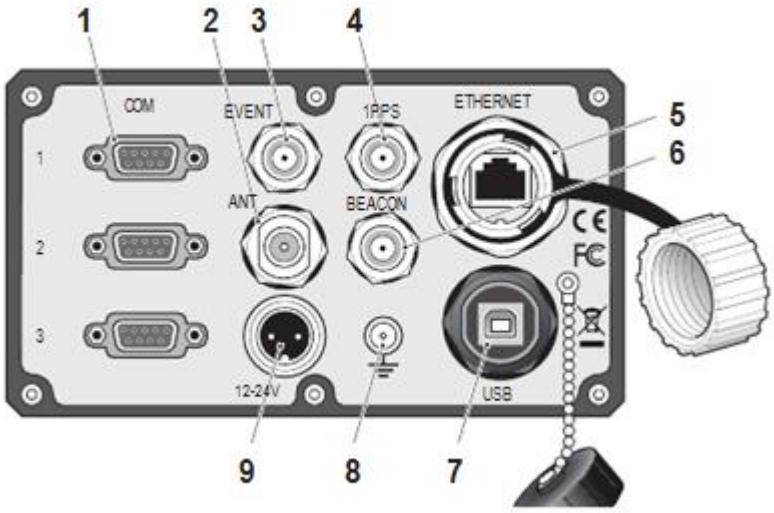


Figure 3. LD5 Rear Panel

1 COM ports 1 to 3, RS232/422 9-way D (Female) type connector
2 L-Band & GNSS antenna N-type connector (GNSS depending on LD5 variant)
3 'EVENT' input BNC connector (currently not used)
4 '1PPS' output BNC connector
5 Ethernet RJ45 connector *****
6 Beacon antenna TNC connector (GNSS depending on LD5 variant)
7 USB type B connector *****
8 Grounding point
9 DC power connector (12–24 VDC)

CAUTION

Do not connect devices to LD5 without first performing a virus scan!

2.2.3 Serial ports

Data may be output from the LD5 on three DB9 female serial ports.

Data output enhanced LD5 (L-Band, GNSS and MF receiver cards fitted).

Example - 'LD5 Mode' Serial Output Settings:

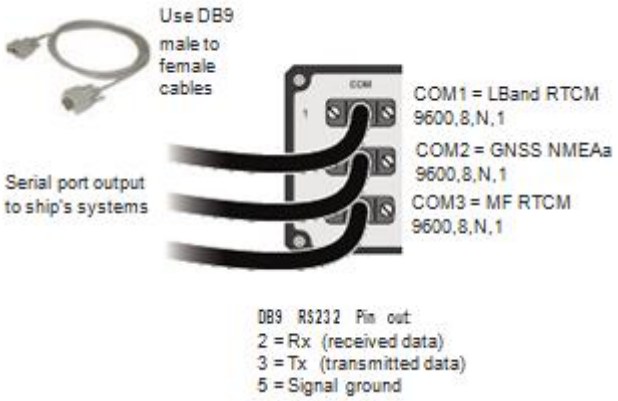


Figure 4. Example Serial Output settings

Serial ports:	3 bidirectional (if configured for applicable data stream)
Format :	RS232 or RS422 (switchable)
Interface type:	DB9
Baud rates:	1200 to 115200

See the Reference Information chapter for details.

NOTE

Data buffering can occur if multiple NMEA messages are output on a low baud rate.

2.2.4 Ethernet Interfaces

An Ethernet RJ45 LAN port is fitted on the rear panel.

All LAN IP port mappings are detailed in the LD5 Operations Manual.

LD5 LAN port mapping – LD5 Operating Mode	
Default output data stream	**Port No.**
RTCMa	9001
GNSS NMEAa	9011
GNSS NMEAb	9012
MF RTCM – A3 models only	9031

LD5 LAN port mapping – QC Operating Mode	
Default output data stream	**Port No.**
RTCMa	9001
GNSS NMEAa	9011
GNSS Raw data	9012
MF RTCM – A3 models only	9031

Typically the LAN output is used in conjunction with VERIPOS Verify QC software or VERIPOS Orion software running on a Windows XP© or Windows 7 computer.

The LAN port has a default fixed IP address: **192.168.2.5**

When attaching the LD5 directly to the PC, VERIPOS recommend that the RJ45 crossover module (supplied) is attached to the PC LAN port, the PC assigned a fixed IP address of: **192.168.2.4**

2.2.4.1 USB Ports

The USB port is for maintenance and support use and should only be used under direction of a VERIPOS technician. Typically this port is used to upgrade firmware or to download logged data.

2.2.4.2 Power Supply

The LD5 requires a 12/24V DC supply and is supplied with an optional (VERIPOS supplied) external 110/240V AC power unit.

2.3 SCOPE OF SUPPLY

The equipment details for your particular installation are contained in the 'Equipment Packing List' documentation which accompanies the LD5 receiver and associated equipment to be installed.

2.3.1 Antennas

2.3.1.1 GNSS / MF Beacon / L-Band antenna V460

See the *Reference information* chapter for details.

2.3.1.2 L-Band antenna V86 (or equivalent)

See the *Reference information* chapter for details.

2.3.1.3 Legacy Antennas

See the *Reference information* chapter for details.

2.3.2 Coaxial questions

2.3.2.1 Times LMR 400

This cable is recommended for the main cable run to the antenna. The main run should be a single cable, joins are not recommended. If possible, measure the cable run and order a pre-terminated cable. These have proved to be more reliable in service.

The use of LMR-400-DB (direct burial) cable is recommended as this contains a water-block, which will prevent water from contaminating the whole cable if the casing is accidentally cut.

See the *Reference information* chapter for detailed specifications of the Times LMR 400 coaxial cable.

2.3.2.2 Times LMR 240

This cable is recommended for use for short runs and is the cable used with our pre-terminated tails for use with mast-head antennas and below decks equipment.

See the *Reference information* chapter for detailed specifications of the Times LMR 240 coaxial cable.

3. INSTALLATION

This section provides guidance on the installation of the LD5 receiver variants.

Contact your supplier or VERIPOS with questions or for advice when installing this equipment.

3.1 INSTALLATION

Installation work for the LD5 varies for:

- The types of antenna(s) to be installed
- Connections for input of data or output of positioning data from the LD5.

3.1.1 LD5 Installation – Schematic Examples

NOTE

The schematic diagrams shown in this section are examples of possible antenna setup arrangements. Please be aware that other antenna configurations are possible. For long-term installations, ***always*** contact VERIPOS to obtain setup drawings specific to your installation as these may differ from those shown below.

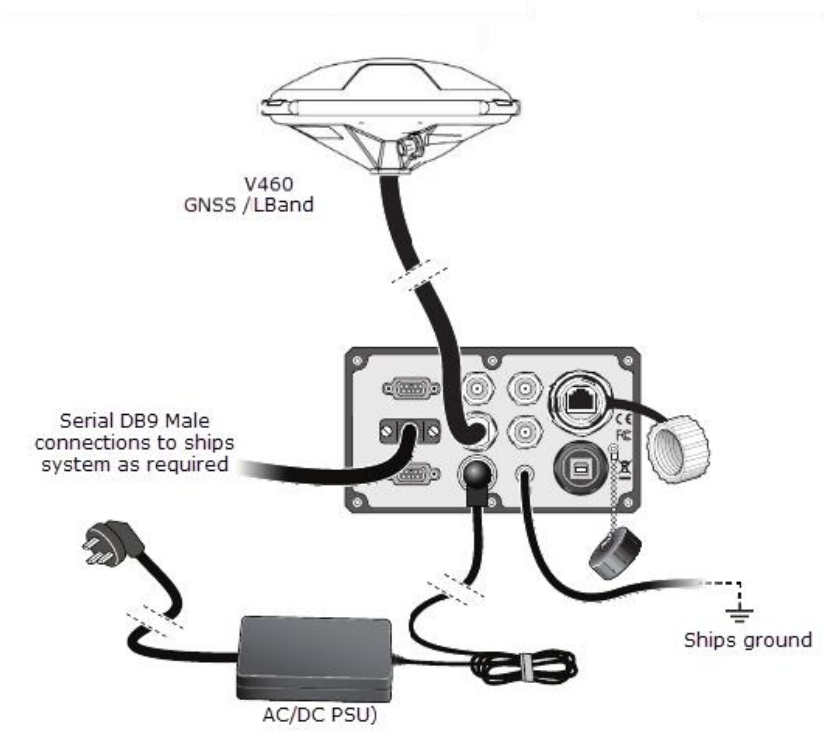


Figure 5. Example of an Installation Drawing for an LD5-A2

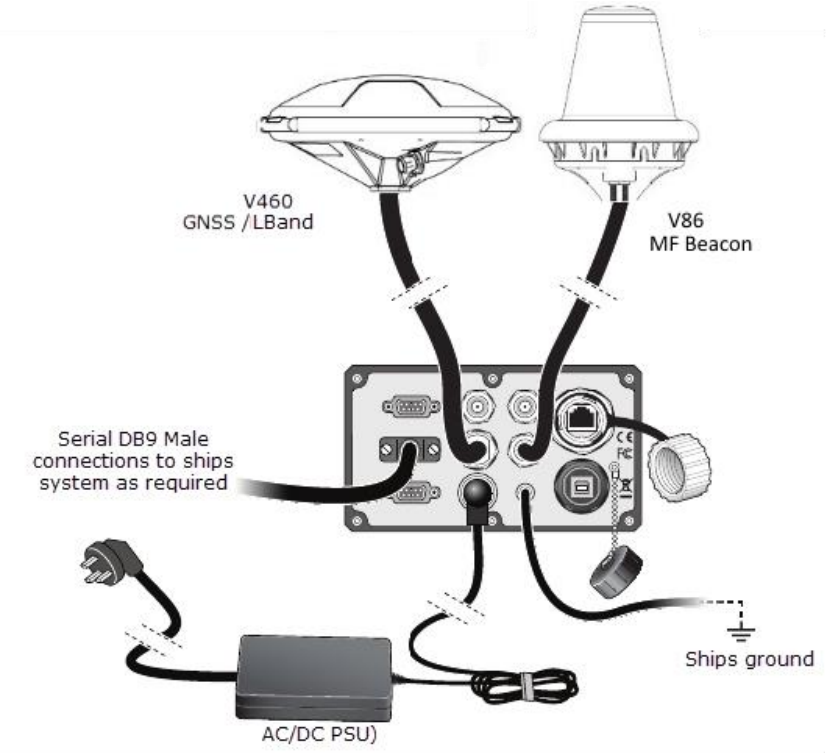


Figure 6. Example of an Installation Drawing for an LD5-A3

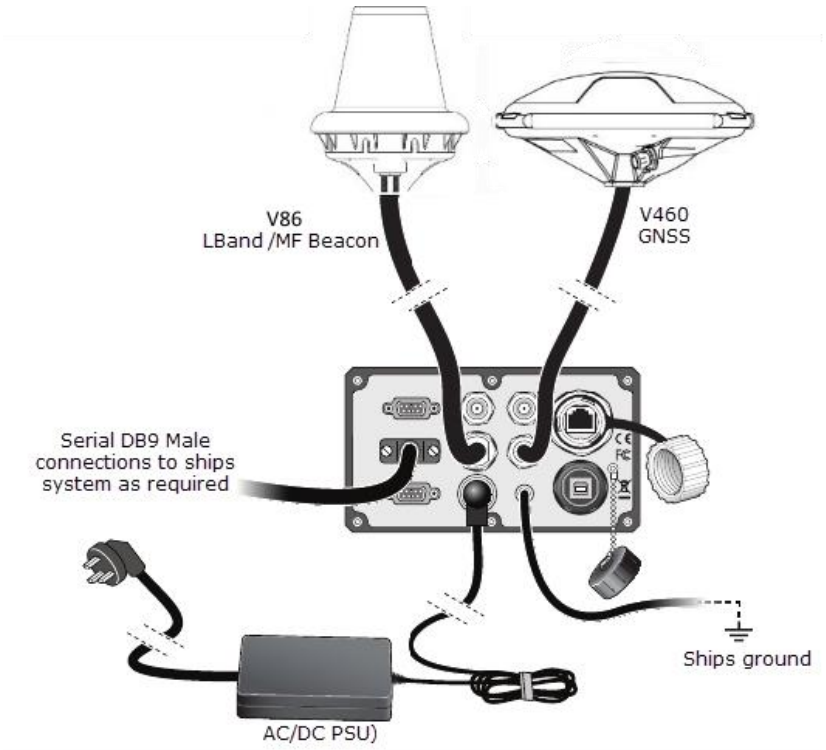


Figure 7. Example of an Installation Drawing for an LD5-A3 (Mod 1)

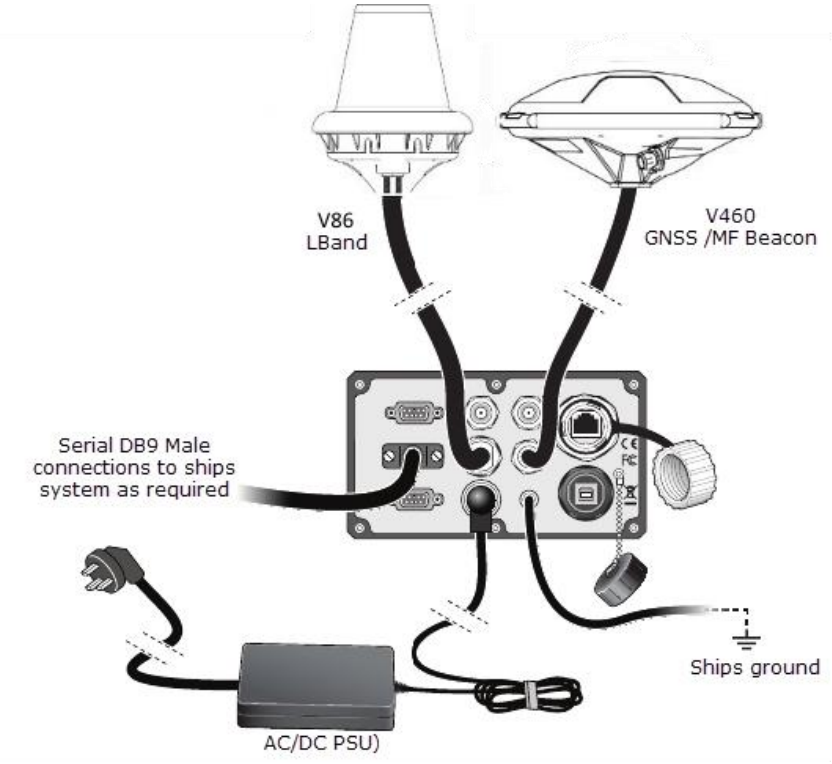


Figure 8. Example of an Installation Drawing for an LD5-A3 (Mod 2)

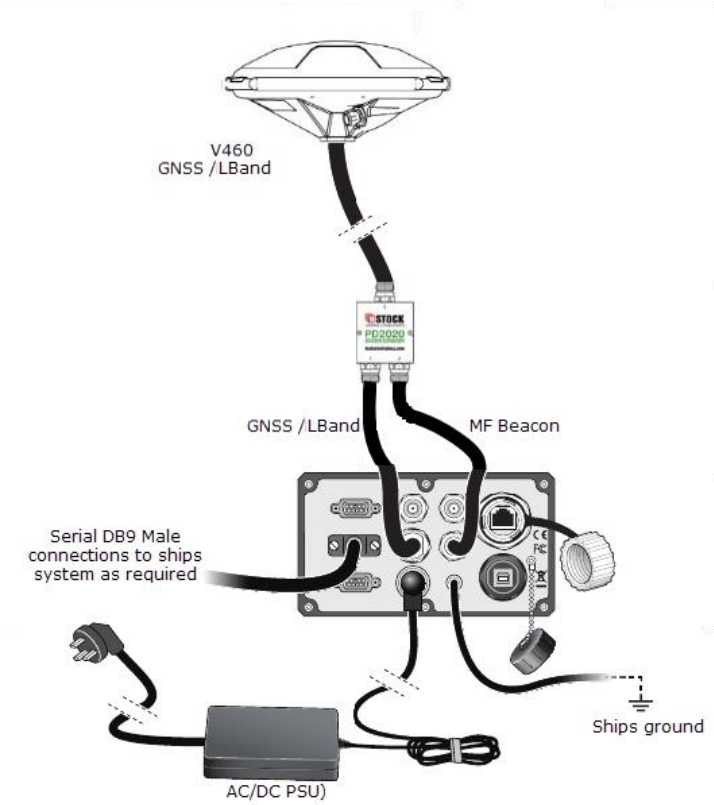


Figure 9. Example of an Installation for an LD5-A3 with Single Antenna

3.1.2 Ventilation Requirements

The LD5 needs 15–25 mm minimum clearance all round to allow a flow of air.

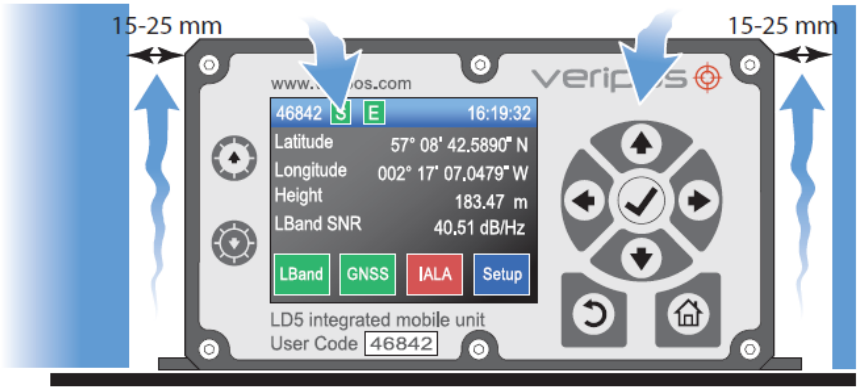


Figure 10. LD5 Ventilation Requirements

3.1.3 LD5 Siting Guides

- Ensure adequate ventilation.
- Avoid locations that experience excessive vibration.
- Avoid exposure to high temperatures.
- Shield the unit from direct sunlight.
- Mount the unit securely to prevent movement.
- Ensure there is easy access to the front panel.
- Ensure adequate access to the rear panel. Avoid mounting in a recess and have sufficient slack left in cables (power, interface and coaxial) for LD5 unit to be removed without disconnection.
- All bends in coaxial cable to be maintained above minimum bend radius.
- Use short tails of flexible coaxial cable (e.g. LMR 240) with appropriate connections to connect antenna coaxial cables to the LD5.
- Connect the LD5 to a ships ground using the grounding point on the rear of the unit.

3.2 ANTENNA INSTALLATION

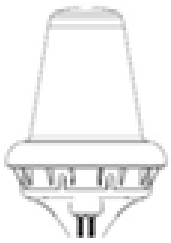
This section provides general guidance on installation of antennas and cabling when installing the LD5 receiver.

It is very important to the on-going performance of your system that a high quality installation is performed. This will ensure optimum performance and reliability.

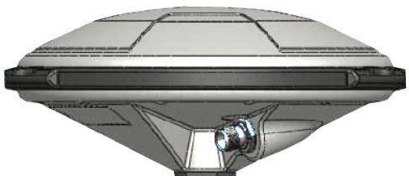
3.2.1 Antennas

The antennas for use with the LD5 are summarised below:

V86



V460



Antenna	Main Signal	Other signal
V86	L-Band	MF Beacon
V460	L1/L2, GPS/GLONASS	L-Band, MF Beacon

NOTE

The antennas mentioned above are those typically currently supplied with the LD5. LD5's have been supplied with other antenna types in the past. Please refer to *Reference Information* Chapter to get information regarding legacy antennas.

3.2.2 GNSS Antenna

The GNSS antenna receives transmissions from GPS and (optionally) GLONASS satellites.

This section describes best practice when positioning and installing your GNSS antenna.

For more details please refer to VERIPOS document "*Antenna & Coaxial Cable Installation Guide*" provided as part of the installation documentation.

3.2.2.1 General

The GNSS antenna is used for vessel positioning and therefore its mounting location is of high importance to the system.

It should be mounted high on the mast with a clear view of the sky in both the horizontal and vertical directions.

If the antenna does not have a full view of the sky there will be times when signals will be blocked, resulting in degraded performance of the system.

Fig 11. Good Installation – Antennas Installed at top of Mast on Retractable Mast Extensions with Good Spacing.

During installation observe the following guidelines:

- Offsets to the GNSS antennas must be measured by a competent person to ensure no errors are introduced to the DP, Survey or Navigation systems

- Care must be taken to ensure that antennas are not installed in the direct path of Radar transmissions, Inmarsat-B Dome transmissions, VSAT transmissions or high power HF whip/wire antenna.

Fig 12. Good Installation – GNSS Antennas Installed on top of the Mast, Minor Signal Masking from Mast Light at low Elevations

If antennas cannot be installed directly at the top of the mast/ships structure, it is essential that the mounting point is sufficiently strong for this purpose. Arrangements must be able to withstand vibration and wind.

Alternatively a pole can be used with a 5/8"x11 UNC threaded end (standard marine mount). The pole can be attached by welding or using “U” clamps as above. This

method allows the GNSS antenna to be mounted without the need for the bracket. Ensure that grease is applied to the threads when installing the antenna.

Figure 13. Examples Antenna Fixing Arrangements

Fit the antenna to the bracket and clamp the bracket to the mounting pole or the mast using “U”-bolts. When mounting the antenna on an extension pole fit the antenna to the pole first for ease of handling at height.

Figure 14. Antenna with Extension Pole

If the threaded pole is already installed up the mast, use a small length of coaxial cable attached to the N-type connector as a safety lanyard for the antenna. Carefully connect the coaxial cable following manufacturers’ guidelines.

Form cable below the antenna into a small loop, approximately150–220 mm (6 to 8in) in diameter. Attach the loop to the mounting pole under the antenna to provide strain relief from the cable.

For more detailed guidance please refer to the VERIPOS document “Antenna and Coaxial Cable Installation Guide”.

3.2.3 L-Band Antenna

Use with the LD5 with suitable variants. Contact Veripos for advice and guidance where required.

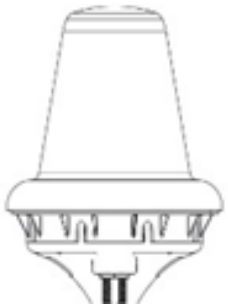


Figure 15. L-Band antenna

The omni-directional Spotbeam antenna must be positioned with a clear view of the sky. Signals received by this antenna come from geostationary satellites. If the antenna is blocked by any part of the vessel e.g. mast, derrick or any other structure/antenna it may lose signal on certain vessel headings, resulting in degraded performance of the system.

The L-Band antenna receives VERIPOS correction data from geostationary satellite transmissions. Installation guidance is similar to that for siting the GNSS antenna.

Take care when siting to avoid areas where part of the vessel structure or another antenna could partially mask the antenna's view of the sky.

For a more detailed guide to siting, please refer to the VERIPOS "*Antenna and Coaxial Cable Installation Guide"* which is provided with equipment.

3.2.3.1 Interface to vessel communication system (Inmarsat)

This section describes the way in which a vessel communication system such as Inmarsat may be incorporated with the antennas to the LD5, for provision of VERIPOS corrections.

Refer to the *'Scope of Supply'* and *'Equipment Packing List'* documentation for details where variants make use of this way of delivering L-Band correction signals to the LD5.

Where a vessel is fitted with an Inmarsat Communications system this may be used to receive the VERIPOS L-Band correction signals, in place of an omni-directional (SPOT) antenna

Considerations:

- The Inmarsat Communications system uses a high gain steerable dish antenna. It can receive low power transmissions from the satellite.

- The Inmarsat narrow beam dish antenna is generally less vulnerable to interference. However it may be prone to signal blockage when mounted lower on a vessel superstructure.

- Different Inmarsat Communications systems use different communication satellites.

  For example:

  - Fleet 55 or 77 use AORE, AORW, POR and IOR

  - Fleet Broadband use 25E, 143.5E and 98W.

  When interfacing an LD5 to Inmarsat equipment the VERIPOS L-Band input is connected to the Inmarsat on - board.

  Some Inmarsat models – e.g. Fleet 77 – have a dedicated output (usually labelled “DGPS output”). This is used to make a direct connection to the VERIPOS L-Band input.

  Where a dedicated output is not present a directional coupler can be inserted between the Inmarsat antenna (dome) cable and the Inmarsat ONBOARD to provide an output for the LD5.

WARNING

The Inmarsat system must be turned off before installing a directional coupler.

Figure 16. Directional Coupler

NOTE

A DC block should be used or the antenna power switched off.

3.2.3.2 Procedure for disabling L-Band voltage

The voltage on the L-Band antenna can be turned off using the LD5 MMI.
Follow instructions in the LD5 Operation manual to disable voltage output in Software.

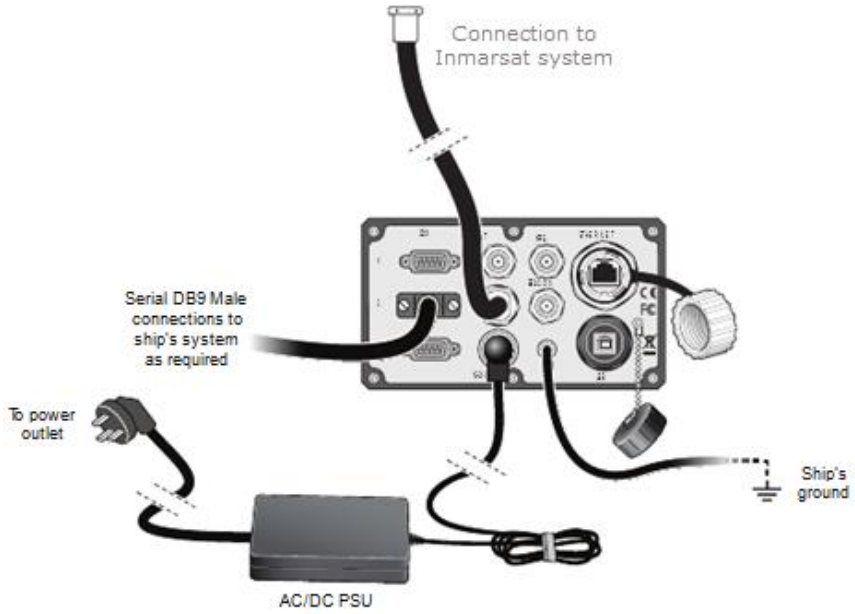

Connection to Inmarsat system
Serial DB9 Male connections to ship's system as required
To power outlet
Ship's ground
AC/DC PSU

Figure 17. Connecting the LD5 Unit to the Inmarsat System

3.2.4 MF Beacon Antenna

Where applicable, the installation of an MF – capable antenna is determined by the use of an MF receiver card. Please refer to the LD5 variant to determine MF capability. Typically, LD5 A3.

This section provides guidance on the installation of an MF Beacon Antenna.

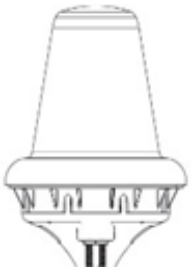


*Figure 18. **MF**/ L-Band antenna – V86*

- The MF antenna supplied may be a V86 antenna, identical to the L-Band antenna. However for use with MF only the antenna mounting requirements are different from an L-Band antenna.

- The antenna must be fitted with clearance from bulkheads and major metal structures

- For MF use only it need not be mounted as high as other antennas as it does not require line of sight to the MF Beacon signal source.

- The antenna is supplied with an angle bracket and U-bolts for mounting.

- The antenna mounting point has a 5/8”x11 UNC thread. As a result a mounting pole can be used with the antenna if desired.

3.3 COAXIAL CABLE INSTALLATION

VERIPOS recommend and supply pre-terminated LMR coaxial cables as they give the best performance in permanent installations. Label each cable carefully at top and bottom identifying the antenna attached.

3.3.1 Maximum recommended cable lengths

The signals received by the antennas will deteriorate at different rates as they are transmitted through coaxial cable. As a result VERIPOS recommend a maximum cable length.

The following table details the maximum length for each signal type.

	L1 GNSS only	L1/L2 GNSS	L-band	MF / HF
RG213 (M17/163-00001)	40 m / 125 ft	30 m / 110 ft	65 m / 210 ft	100 m / 328 ft
LMR400	70 m / 235 ft	52 m / 175 ft	120 m / 390 ft	200 m / 656 ft
LDF4-50	130 m / 425 ft	110 m / 360 ft	210 m / 700 ft	350 m / 1148 ft

3.3.2 General

VERIPOS recommended cable for the antenna runs is LMR 400

Terminated tails of LMR 240 are used at either end for ease of attachment to hardware.

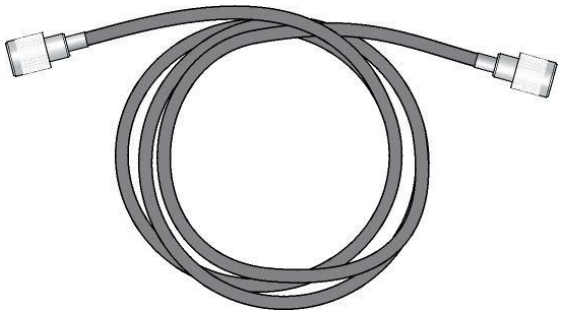


Figure 19. Terminated tails of LMR 240

When running multiple coaxial cables VERIPOS recommend labelling to ensure cables are attached to the correct antennas and equipment. Survey the route of the antenna cabling to ensure:

1. The total length of the cable run does not exceed the supplied cable length for this installation. Contact your supplier or VERIPOS if this is the case.

2. The cable does not cross or run parallel with any **single phase or three phase mains** cable (110 VAC, 220 VAC or 440 VAC) or any high power RF cables leading to transmitting devices such as Inmarsat B and VSAT domes.

3. The cable **avoids fluorescent lights**.

4. A **support wire** is used where the cable run has to cross a free space and does not rely solely on cable ties for support.

5. Sufficient space is available in the selected cable entry through the bulk head for the connectors to pass through without damage. If the connector cannot pass through the cable entry it may be necessary to cut the connector off and re-terminate once the cable has been passed through.

6. The cable is **not pinched**.

7. The route is **free from all burrs or sharp edges** that could damage the cable jacket.

8. All **connectors and couplers are properly sealed** from the environment with self-amalgamating tape and electrical tape.

9. **Stress loops** are fitted to prevent excess force on the connectors, in particular the antenna connectors.

10. The **minimum bend radius** for the cable is not exceeded.

Once cables are in place **seal all connections with self-amalgamating tape** for protection against the marine environment.

Figure 20. Typical Cable Installation in Bridge and Mast Area

3.4 COAXIAL CABLES TO ANTENNAS

Up to two types of connections to antennas may be connected to the rear of the LD5.

These are shown below;

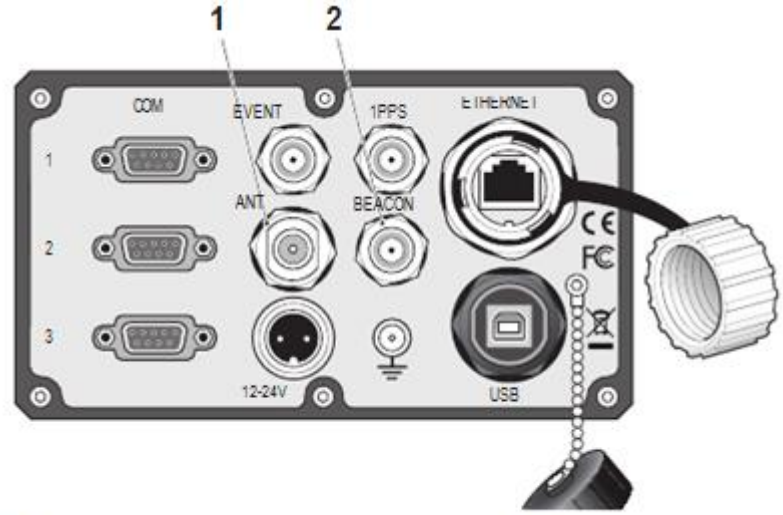


Figure 21. Example of Antenna Connectors on an LD5

Key:

1. N- Type connection - Options for connections are:

Variant	Signal	Typical antenna
A1	L-Band	V86
A2	L-Band, GNSS	V460
A3	L-Band, GNSS	V460
A2 ***mod1****	L-Band	V86
A3 ***mod1****	L-Band, MF	V86
A3 **mod 2***	L-Band	V86

2. TNC connection - Options for connections are:

Variant	Signal	Typical antenna
A1	N/A	N/A
A2	N/A	N/A
A3	MF Beacon	V86
A2 ***mod1****	GNSS	V460
A3 ***mod1****	GNSS	V460
A3 **mod 2***	GNSS & MF	V460

** The LD5 identification label indicates which mod (modification) of the LD5.*

3.5 INTERFACE

3.5.1 LD5 Rear connections

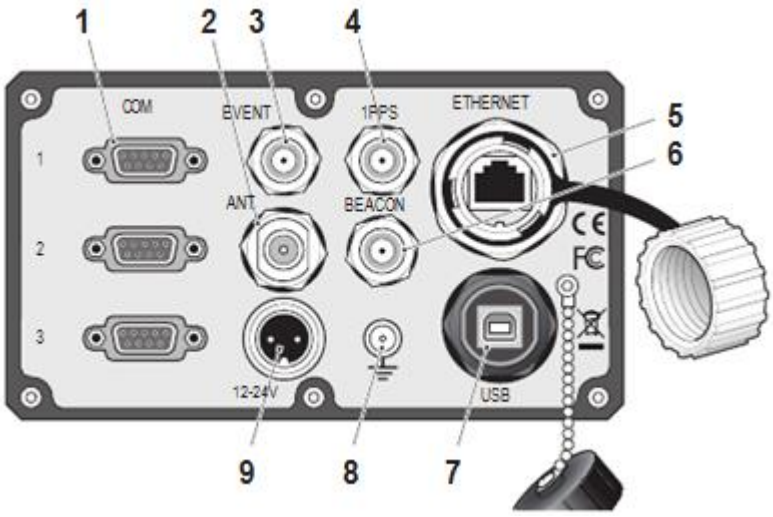


Figure 22. LD5 Rear Connections

1 COM ports 1–3 (RS232/422) galvanically isolated
2 N-type antenna connector
3 'EVENT input (currently not used)
4 '1PPS' output
5 Ethernet connector
6 TNC antenna connector
7 USB typeB connector
8 Grounding point
9 DC power connector (12–24 VDC)

LD5 has three serial ports (COM 1–3) to make connections to ships system. The default is EIA/RS232.

Port config settings required will depend on the ***LD5 Operating mode***.

Set unit mode to "LD5" **or** to "QC" when working with Verify QC software.

See the LD5 Operation manual on how to amend the LD5 mode.

For reference the **LD5 mode** default settings are shown below:

COM Port	*Data String*	Settings (EIA/RS232)	Baud rate (bps)
COM1	*RTCM*	8,N,1	9600
COM2	*GNSS, NMEA*	8,N,1	9600
COM3	*MF RTCM (where available)*	8,N,1	9600

See the *Reference information* chapter for pin-out details and contact VERIPOS for advice where required.

The LD5 has a rear connector for output of a 1PPS (one pulse per second) signal, used by external equipment for accurate time synchronisation to navigation systems or multi-beam sonar.

Details of any 1PPS output requirement and equipment will be included in the '*Scope of Supply*'.

3.5.2 Ethernet interface

An Ethernet RJ45 connector is fitted on the LD5 rear panel. This can have static or DHCP addresses.

VERIPOS recommend the use of a static IP address.

The LD5 has a fixed IP of **192.168.2.5** as default.

Specific guidance for interconnect to vessel equipment can be provided. Contact the VERIPOS Helpdesk for advice.

3.5.2.1 LAN Port table

LD5 data outputs are available on predefined LAN port numbers. Some of these will vary depending on the LD5 operating mode. The available LAN port numbers are:

LD5 LAN Port mapping – LD5 Mode	
Default output data stream	**Port No.**
RTCMa	9001
RTCMb	9002
L-Band Config	9003
GNSS NMEAa	9011
GNSS NMEAb	9012
MF RTCM	9031
MF Config	9033

LD5 LAN Port mapping – QC Mode	
Default output data stream	**Port No.**
RTCMa	9001
RTCMb	9002
L-Band Config	9003
GNSS NMEAa	9011
GNSS Raw	9012
MF RTCM	9031
MF Config	9033

LD5 LAN Port mapping – Maintanance Mode	
Default output data stream	**Port No.**
RTCMa	9001
RTCMb	9002
L-Band Config	9003
GNSS NMEAa	9011
GNSS Config	9012
MF RTCM	9031
MF Config	9033

3.5.3 Interface cabling

This section details the types of data cables connected to systems and used by systems on the vessel.

Data interface cables from the LD5 will use RS232 cables.

The data interface cabling attaches to the LD5 ports for input and output of data.

Cables and adapters supplied:

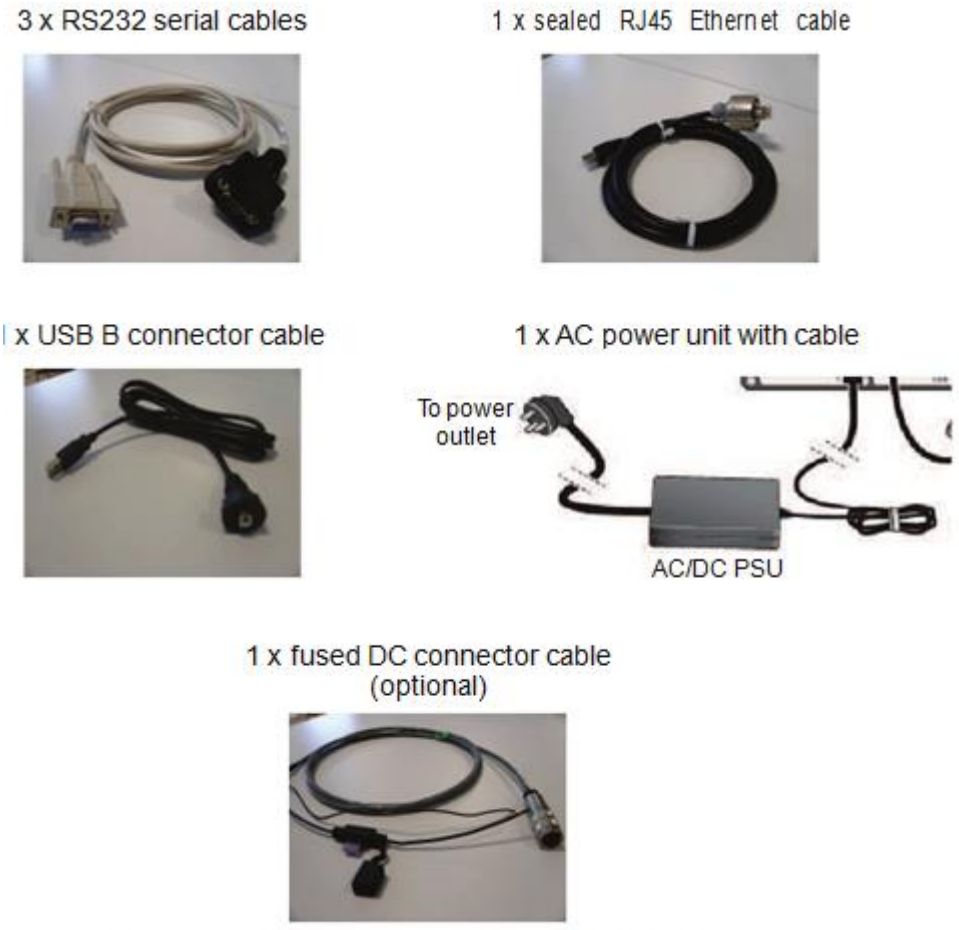

3 x RS232 serial cables
1 x sealed RJ45 Ethernet cable
x USB B connector cable
1 x AC power unit with cable
To power outlet
AC/DC PSU
1 x fused DC connector cable (optional)

Figure 23. Cables and Adapters Supplied with the LD5 unit

3.6 EQUIPMENT RACK

This section provides guidance on locating and installing an equipment rack to house the LD5 including ventilation, securing the unit and instilling measures to limit vibration. It also details what may optionally be pre-installed in the rack.

Rack specification will vary for each installation to suit the application.

The ‘Scope of Supply’ and ‘Equipment Packing List’ documentation will detail what is provided. Use in conjunction with guidance in this section.

3.6.1 Rack installed LD5 – Guidance

Typically shipment will include coaxial tails for attaching the antennas to the rear of the LD5.

The location of the rack must be selected using the same criteria as previously described for the LD5, with particular consideration for ventilation and access.

Before securing the rack base plate check that the LD5 rear connectors and switches are easily accessible in the chosen location.

Ventilation slots and apertures must not be obscured.

Earth connection on the rear of the LD5 must be connected to ship's ground.

The rack frame and base plate should be individually grounded.

Power supply for the units should be taken from a clean-power source as detailed in the 'Scope of Supply' or 'Equipment Packing List' documentation. Typically this is derived from an UPS (Uninterruptible Power Supply).

NOTE

To prevent problems of interference or increased heat dissipation, no additional equipment should be mounted in this rack without first consulting VERIPOS.

3.7 POWER AND CABLING

This section details the type and typical source for power supply to the LD5.

VERIPOS recommend using the supplied external AC to DC Power supply unit which requires 100–240 VAC, 47–63 Hz.

If using a DC power source (12 – 24V), an optional fused cable can be supplied. Details and power source specification available from VERIPOS.

Power requirement of the LD5:

Input Voltage:	12 – 24 VDC
Power consumption:	7.5W

The LD5 unit can be supplied with a DC power cable.

The unit should be connected to a clean supply, e.g. ships UPS system.

Contact the VERIPOS Helpdesk if you need advice on supply of power to the LD5.

4. REFERENCE INFORMATION

4.1 LD5 TECHNICAL SPECIFICATIONS

This equipment is for indoor use only and meets performance specification within an ambient temperature range of -15 °C to +55 °C and a maximum relative humidity of 95%.

Equipment complies with EN60945:2002 [5] for “protected” equipment.

Cable specifications: Please refer to the *Reference information* chapter for details.

The LD5 is sealed to the IP66 specification.

4.1.1 Mechanical

The LD5 is sealed to the IP66 specification.

Figure 24. LD5 Overview

Dimensions

Height	90 mm
Width	158 mm
Depth	227 mm
Weight (max)	2.25 kg

4.1.2 Environmental

Enclosure material	Aluminium
Operating temperature range	-15 ℃ to +55 ℃
Storage temperature range	-20 ℃ to +70 ℃

4.1.3 Safety considerations

Though the test conditions for the LD5 unit provide for a max. operating temperature of +55 °C, continuous operation of all electronic components should if possible take place at ambient temperatures of only +25 °C.
This is a prerequisite for long life and low service costs.

4.1.4 Electrical

AC power unit	100–240 VAC
DC power input	12–24 VDC
Power consumption -	
basic configuration	<4 W
intermediate configuration	<7.2 W
-enhanced configuration	<7.5 W
Display	9cm (3.5”0) colour
IEC60945	certified

4.1.5 Compass safe distance

Conforms to IEC 60945.

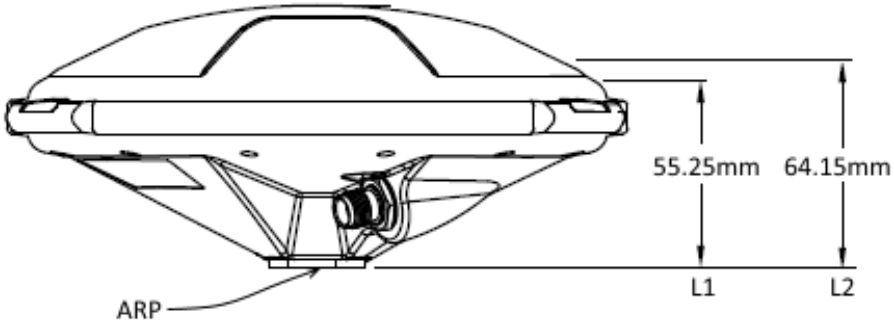
4.1.6 Specification of Antennas

4.1.6.1 V460

L-Band/GPS/GLONASS	1525-1610 MHz
GPS L2/GLONASS L2	1160-1252 MHz
Fitted with a narrow band filter for interference rejection	
LNA gain	45dB
DC Voltage Input	3.0 to 15.0V
RF Input Connector	TNC socket
Material	Weatherproof polymer plastic
Mount	5/8” tripod thread connector
Temperature Range	-55 to +85°C
Certification	IEC 60945
Diameter	7.5” / 19.05cm
Height	3.17” / 8.05cm
Weight	1.6lbs / 0.73kg

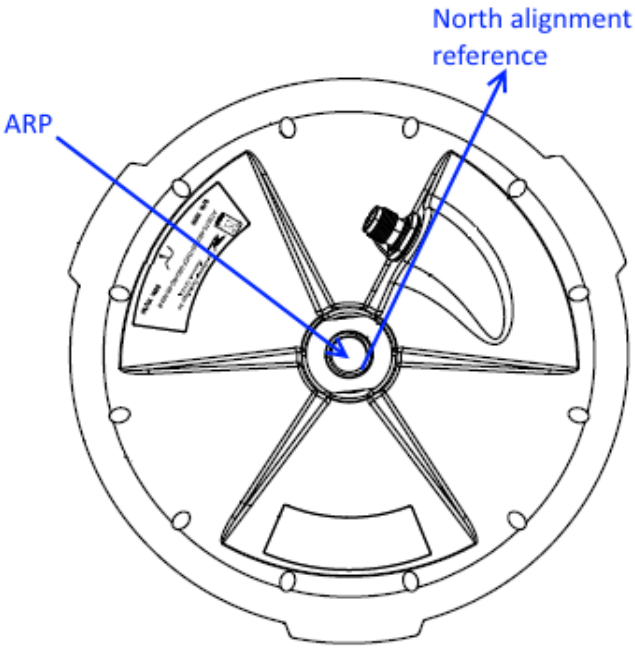
4.1.6.2 V460 Antenna – Phase Centre Values

The diagram below shows the antenna reference point (ARP) from which the phase centre values are measured. It also shows the V460 vertical (Up) phase centre values for the GNSS L1 and L2 frequencies:



V460 Phase Centre Values above ARP

The below diagram shows the ARP at the antenna base and the antenna North alignment reference:



The table below details the North, East and Up phase centre values for the GNSS L1 and L2 frequencies:

	Relative to Antenna Reference Point (ARP)		
GNSS Frequency	**North (mm)**	**East (mm)**	**Up (mm)**
L1	2.78	-1.27	55.25
L2	0.82	-1.09	64.15

4.1.6.3 V86

LNA Gain	36dB
DC Voltage Input	5.0 to 15.0V
Fitted with a narrow band filter for interference rejection	
RF Input Connector	N-type female
Material	Weatherproof polymer plastic
Mounting	Standard land survey 5/8” tripod thread connector
Temperature Range	-50 to +85°C Storage, -40 to +70°C Operating
Certification	IEC 60945
Diameter	14.25cm

4.1.7 Legacy Antennas

Although the V460 and V86 are the antenna types currently supplied as standard, other antenna types have been supplied for use with the LD5 in the past. Details of some of the legacy antennas which may be used with the LD5 are described in this section.

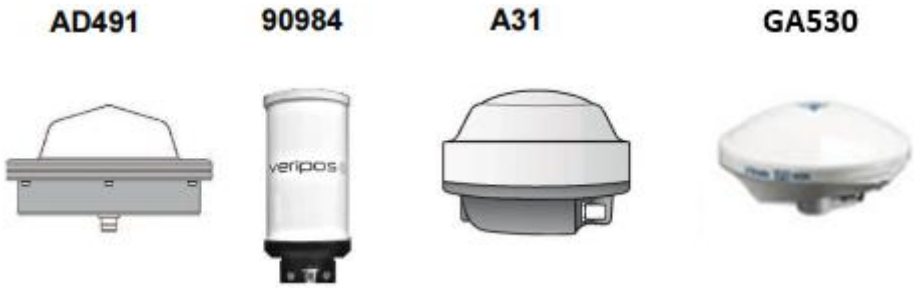


Figure 25. Legacy antennas

NOTE

The legacy antennas stated in this manual covers the majority of antenna types which may be used with an LD5 however others may be compatible. Please contact VERIPOS if you have any queries regarding compatibility of antenna models not defined in this manual.

4.1.7.1 GA530

The GA530 was primarily used for reception of L1/L2 GPS signals and can also receive L-Band and MF correction signals. **The GA530 can NOT receive GLONASS satellites.**

GA530 Specifications:

Frequencies	L1/L2 GPS, L-Band, MF Beacon
Operating Temperature	-40 to +70°C
Storage Temperature	-55 to +85°C
Dimensions	
-height	74mm (2.9”)
-diameter	152mm (6”)
Weight	0.66kg (1.45 lbs)
Antenna cable connector	TNC sealed
Mounting	5/8”-11 UNC thread mount
Environmental	MIL-810-F
Humidity	100% humidity proof, fully sealed
Feed	2 point
LNA input	5.5 – 18 VDC (110mA)
LNA gain	L1 45 dB / L2 45 dB
Compliance	IEC 60945

4.1.7.2 AD491

The AD491 was primarily used for reception of L1/L2 GNSS (GPS & GLONASS) signals and can also receive L-Band correction signals.

AD491 Specification:

Features

Combined L1/L2 GNSS and DGNSS antenna with interdigital filters

Ruggedised marine antenna

Omni-directional patch antenna

Integrated cavity filter for interference rejection

Technical specifications

Antenna radiation pattern	Omni-directional hemispherical
Antenna polarisation	RHC
Antenna frequency	L1/L2 GPS, L1/L2 Glonass, L-Band
Supply voltage	+5 to +20 VDC
Supply current	50 mA typical
LNA gain	56 +/-2 dB
Operating temperature	-30 to +70°C
Connector type	N-type
Maximum cable length	52m of LMR400 / 30m of RG213
Weight	3.2 kg
Dimensions	
-height	111 mm
-diameter	210 mm
Mounting	5/8”x11 UNC

4.1.7.3 A31

The A31 was primarily used for reception of MF Beacon signals and can also receive L1 GPS and L-Band correction signals. **The A31 can NOT receive L2 GPS or any GLONASS satellite signals.**

A31 Specifications:

Main	
MF Beacon frequency range	283.5 – 325 kHz
Beacon LNA gain	30 dB
Options	
L-Band frequency range	1.555 – 1.585 GHz (L1)
L-Band LNA gain	30 dB
GNSS reception	GPS
GNSS frequency	1.575 GHz (L1)
GNSS LNA gain	30 dB
GNSS LNA noise	<2 dB
Power input	
Input voltage	+5 to +12 VDC
Input current	50-60 mA
Mechanical	
Enclosure	Lexan
Dimensions	
-height	10.4 cm (4.1”)
-diameter	14.5 cm (5.7”)
Weight	0.73 kg (1.62 lbs)
Mount	1” coarse thread (5/8” adapter available)
RF connector	TNC
Environmental	
Storage temperature	-40 to +85°C
Operating temperature	-30 to +70°C
Enclosure rating	IP69K
Shock and vibration	EP455
Humidity	95% non-condensing

4.1.7.4 90984

The 90984 was used for reception of L-Band correction signals **only**. **The 90984 can NOT receive any other signal types.**

Features

Ruggedised marine antenna

Omni-directional helical antenna gives good performance in VERIPOS L-Band coverage

Integrated cavity filters for interference rejection – Output at L-Band (no down converter)

Technical specifications

Antenna radiation pattern	Omni-directional
Antenna polarisation	RHC
Antenna frequency	1525-1559 MHz
Antenna gain	4 dBiC at zenith
	0 dBiC at 20° above horizon
Filter rejection	>50 dB (DC-1450 MHz)
	>55 dB (1625-1661 MHz)
Supply voltage	+5 to +20 VDC
Supply current	38 mA typical
LNA gain	30 dB
Operating temperature	-20 to +60°C
Connector type	N-type
Maximum cable length	120m LMR400 / 50m RG213
Weight	1.4 kg
Dimensions	
-height	285 m
-diameter	110 mm
Mounting	4 off 7mm dia holes at 46.5mm centres (two U-clamps supplied for 1 inch pole mounting)

4.1.8 Summary Specifications of Module Receiver Cards

Typically VERIPOS provide with the system pre-terminated cables and tails for use with both L-Band and GNSS antennas (see the 'Equipment Packing List').

VERIPOS recommend use of Times Microwave coaxial LMR cable for installation of all antennas. See the *Reference information* chapter for details.

4.1.8.1 L-Band Module (LBR-1)

Single channel L-Band modem	
Frequency Range	1525 – 1559MHz
Baud Rate	1200
Power Consumption	
Nominal Operation	1.25W (not including any active antenna)
Standby Mode	3.5mW
Temperature Range	
Operational	-40 to +70°C
Storage	-55 to +85°C

4.1.8.2 GNSS Module AsteRx2e

NOTE

The features below relate to the GNSS card fitted within the LD5. Some of these features are not currently available or selectable on the LD5 presently.

***LD5 outputs are all presently at 1Hz and cannot be changed.**

Product features:

- Dual-frequency L1/L2 code/carrier tracking of GPS and GLONASS signals
- 136 hardware channels for simultaneous tracking of all visible satellites in GPS and GLONASS constellations
- 25 Hz data output rate*
- A 'Posteriori Multipath Estimator' technique (APME) differential GPS (base station and rover)
- Includes up to three SBAS channels (EGNOS, WAAS, other)
- Innovative and flexible power management under user control
- x PPS output (x = 1, 2, 5, 10)
- Two event markers
- RAIM included
- Raw data output (code, carrier, navigation data)
- Four high speed serial ports
- One full speed USB port
- Highly compact and detailed 'Septentrio Binary Format' (SBF) output
- NMEA v2.30 output format, up to 10 Hz
- RTCM v2.2, 2.3, 3.0 or 3.1
- CMR2.0 and CMR+

Technical Specifications:

Operating Temperature	-40 to +70°C
Storage Temperature	-40 to +85°C
Humidity	5% to 95% (non-condensing)
1PPS Accuracy	10 nsec
Event Accuaracy	<10 nsec

Measurement Precision

C/A Pseudo Ranges	5cm (GPS)
	0.16m (GPS)
	7cm (GLONASS)
	0.25m (GLONASS)
GPS P2 Pseudo Ranges	0.1m
GLONASS P Pseudo Ranges	0.1m
L1 Carrier Phase	1mm
L2 Carrier Phase	1mm
L1/L2 Doppler	0.02 Hz

Time to First Fix

Cold Start	<45sec
Warm Start	<20sec
Re-acquisition (Avg.)	1.2sec
Tracking Performance (C/N 0 Threshold)	
- Tracking	26dB Hz
- Acquisition	33dB Hz
- Acceleration	10g
- Jerk	4g/sec

4.1.8.3 MF Module (MF Module SBX-4)

The LD5 variant may optionally have this card installed. A two channel MF demodulator compatible with third party MF beacon transmissions.

Operating Specifications

Channels	2 Channel parallel tracking
Frequency Range	283.5 to 325.0 kHz
Channel Spacing	500 Hz
Demodulation	Minimum shift keying (MSK)
MSK Bit Rates	50, 100 and 200 bps
Operating Modes	Manual, automatic and database
Cold Start Time	<1 minute typical
Re-acquisition Time	<2 seconds typical
Sensitivity	2.5 µV/m for 6 dB SNR@200 bps
Out of Band Rejection	60 dB <204 kHz and >404 kHz
Spurious Response	<-55 dB (0.1 to 1.6 MHz)
Ripple (in-band)	3 dB
Dynamic Range	100 dB
Frequency Offset	61 dB ±1 dB@f0 ±400 Hz
Antenna Input Impedance	50 ohm

4.2 CABLING AND CONNECTORS

This section contains details on the AC and DC power connectors and the cable termination used for connection to antennas.

VERIPOS recommend that prefabricated main cables and coaxial tails are used for connection of antenna to the VERIPOS below decks equipment.

4.2.1 Interface and serial port information

This details the pin out details for the LD5 receiver connections.

Ports COM 1 to COM 3 on the rear panel are 9 way D-type serial female connectors.

4.2.1.1 LD5 COM ports

Default configuration for each COM port is:

- 1 start bit
- 8 data bits
- No parity
- 1 stop bit

This information may be required when interfacing to ships systems using RS-232/422 standards. The LD5 is the transmitting device.

DB9 pin	Function	
	RS-232	RS-422
1	Not connected	Not connected
2	TxD	Tx(-)
3	RxD	Rx(-)
4	Not connected	Not connected
5	Signal ground	Signal ground
6	Not connected	Tx(+)
7	Not connected	Not connected
8	Not connected	Not connected
9	Not connected	Rx(+)

NOTE

LD5 outputs are currently output at 1Hz and cannot be changed.

4.2.2 Power connection to the LD5

Veripos provide connections to the LD5 for AC and DC. Diagrams showing the connections are shown below.

Figure 26. Circular Industrial Series 423 Connector

Description	
Manufacturer	Binder
Part no.	995 102 09 02
Connector type	Circular industrial
Series	423
Connector body material	Brass
Gender	Receptacle
Contact gender	Socket

Figure 27. AC Assembly Diagram

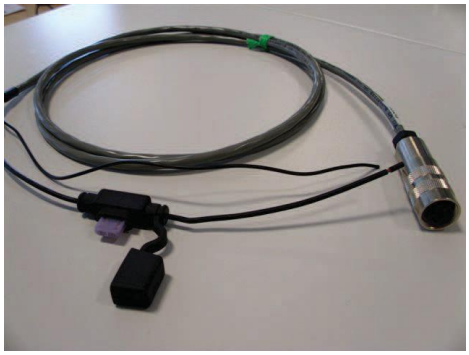


Figure 28. DC Cable Assembly Including Fuse

4.2.3 DC power

Veripos supply an AC to DC power supply. Where users wish to connect to a ships protected DC supply (12/24 VDC) please contact Veripos should you require advice.

4.2.4 Times LMR 400

4.2.4.1 Electrical specifications

Performance Property	Units	US	(metric)
Velocity of propagation	%	85	
Dielectric constant	N/A	1.38	
Time delay	nS/ft (nS/m)	1.20	(3.92)
Impedance		50	
Capacitance	pF/ft (pF/m)	23.9	(78.4)
Inductance	uH/ft (uH/m)	0.060	(0.20)
Shielding effectiveness	dB	>90	
DC resistance Inner conductor Outer conductor	 /1000 ft (/km) /1000 ft (/km)	 1.39 1.65	 (4.6) (5.4)
Voltage withstand	VDC	2500	
Jacket spark	Vrms	8000	
Peak power	kW	16	

4.2.4.2 Mechanical specifications

Performance property	Units	US	(metric)
Bend radius, installation	in. (mm)	1.00	(25.4)
Bend radius, repeated	in. (mm)	4.0	(101.6)
Bending moment	ft-lb (N-m)	0.5	(0.68)
Weight	lb/ft (kg/m)	0.068	(0.10)
Tensile strength	lb (kg)	160	(72.6)
Flat plate crush	lb/in. (kg/mm)	40	(0.71)

4.2.4.3 Environmental specifications

Performance property	°F	°C
Installation temperature range	-40 to +185	-40 to +85
Storage temperature range	-94 to +185	-70 to +85
Operating temperature range	-40 to +1851	-40 to +85

4.2.5 Times LMR 240

4.2.5.1 Electrical specifications

Performance Property	Units	US	(metric)
Velocity of propagation	%	84	
Dielectric constant	N/A	1.42	
Time delay	nS/ft (nS/m)	1.21	(3.97)
Impedance		50	
Capacitance	pF/ft (pF/m)	24.2	(79.4)
Inductance	uH/ft (uH/m)	0.060	(0.20)
Shielding effectiveness	dB	>90	
DC resistance Inner conductor Outer conductor	 /1000 ft (/km) /1000 ft (/km)	 3.2 3.89	 (10.5) (12.8)
Voltage withstand	VDC	1500	
Jacket spark	Vrms	5000	
Peak power	kW	5.6	

4.2.5.2 Mechanical specifications

Performance property	Units	US	(metric)
Bend radius, installation	in. (mm)	0.75	(19.1)
Bend radius, repeated	in. (mm)	2.5	(63.5)
Bending moment	ft-lb (N-m)	0.25	(0.34)
Weight	lb/ft (kg/m)	0.034	(0.05)
Tensile strength	lb (kg)	80	(36.3)
Flat plate crush	lb/in. (kg/mm)	20	(0.36)

4.2.5.3 Environmental specifications

Performance property	°F	°C
Installation temperature range	-40 to +185	-40 to +85
Storage temperature range	-94 to +185	-70 to +85
Operating temperature range	-40 to +185	-40 to +85

4.2.6 LMR 400 – Times Microwave TC-400-NM N-type male connector

The Times Microwave TC-400-NM connector comes with the following parts:

To properly terminate LMR 400 cable with the TC-400-NM connector, the following tools should be used:

Times Microwave cable cutting tool:

P/n: CCT-01

Times Microwave LMR 400 cable prep tool:

P/n: ST-400C

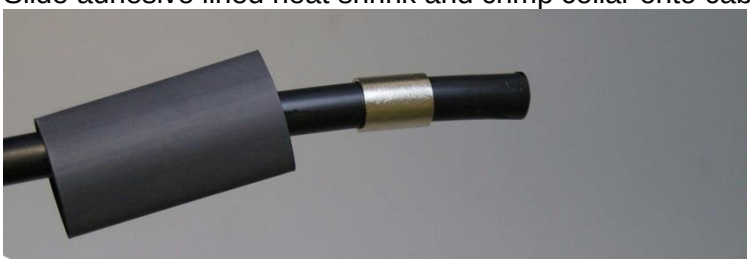
Times Microwave deburring tool:

P/n: DBT-01

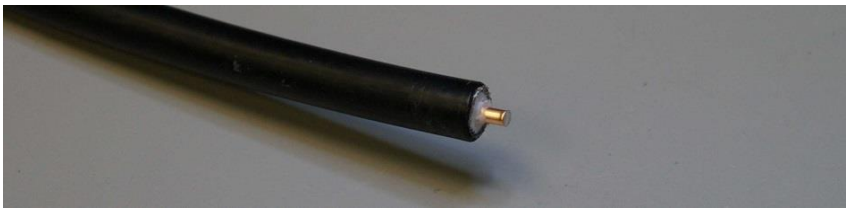
Times Microwave LMR 300/400 crimp tool:

P/n: CT-300/400

1. Slide adhesive lined heat shrink and crimp collar onto cable.



2. Use side **1** of the cable prep tool to expose the centre conductor by inserting cable into tool and rotating tool clockwise until no resistance can be felt.



If the cable prep tool is not available, carefully trim cable to the following dimensions

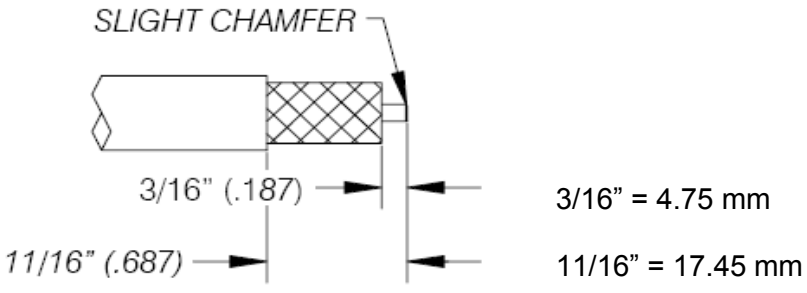
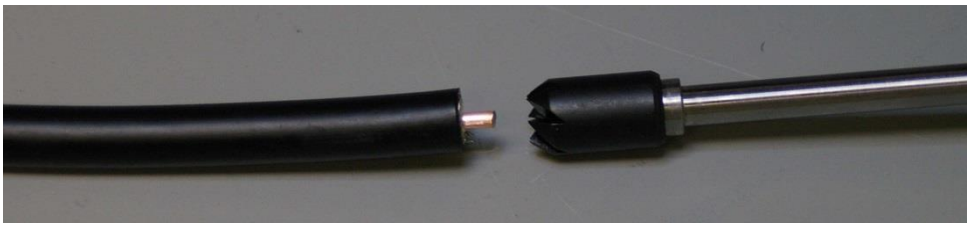
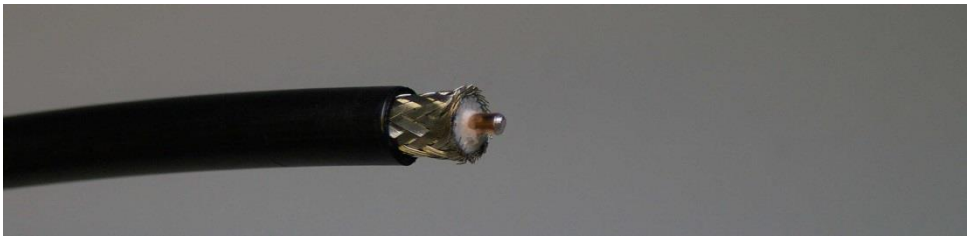


Diagram courtesy of Times Microwave

3. Remove any residual plastic from centre conductor before deburring with deburring tool or a fine metal file.



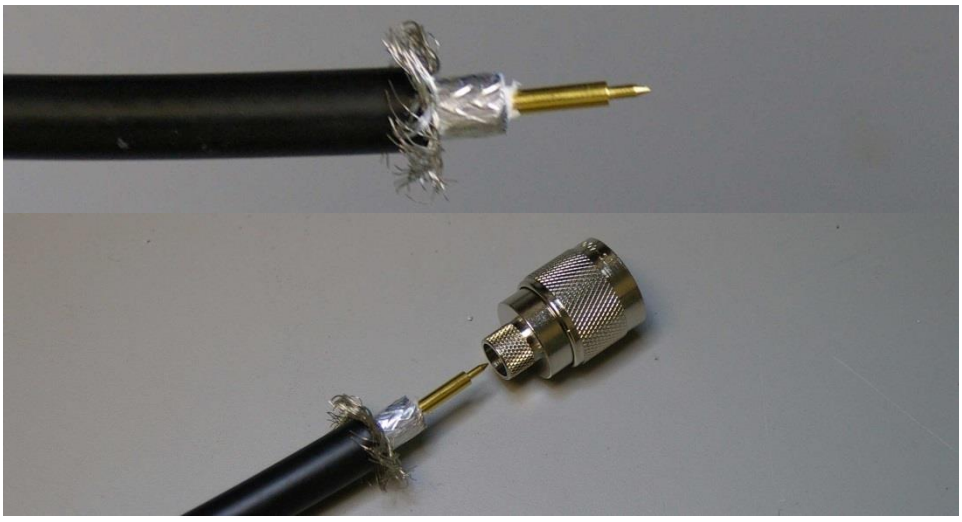
4. Trim cable jacket using side **2** of the cable prep tool by inserting cable and rotating tool clockwise until no resistance can be felt.



5. Slide centre pin over centre conductor and seat firmly against cable dielectric. Solder in place by applying a minimal amount of solder to the hole in the side of the pin.

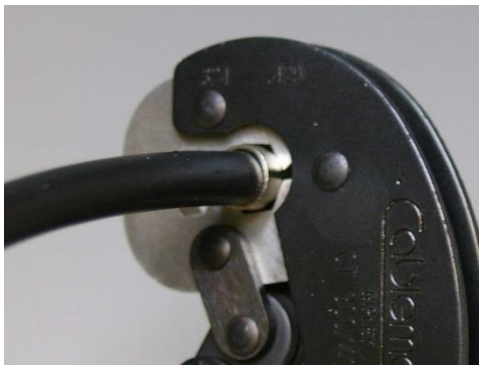
The soldering iron should be set to a high heat setting and tinned before being applied to the centre pin. The application of heat should be done care- fully since too little will result in a poorly soldered joint, which will adversely affect performance, and applying too much will melt the dielectric.

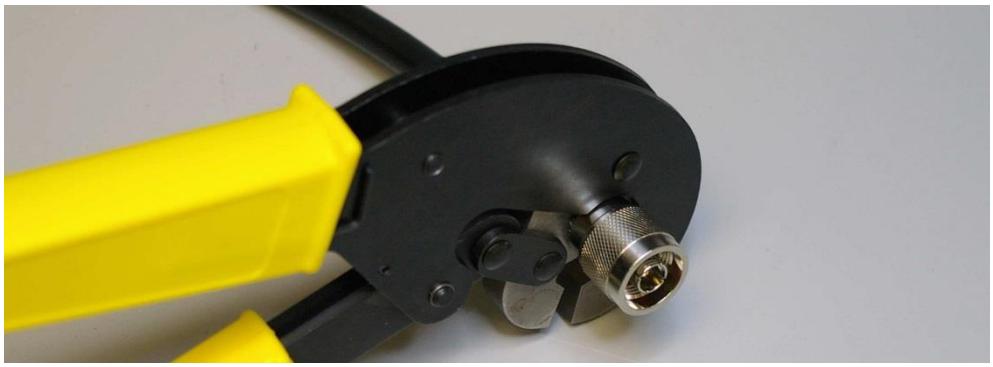
6. Flare the braid and check to make sure no aluminium foil is touching the centre pin. Insert cable, centre pin and aluminium foil into connector body making sure that the braid remains outside.



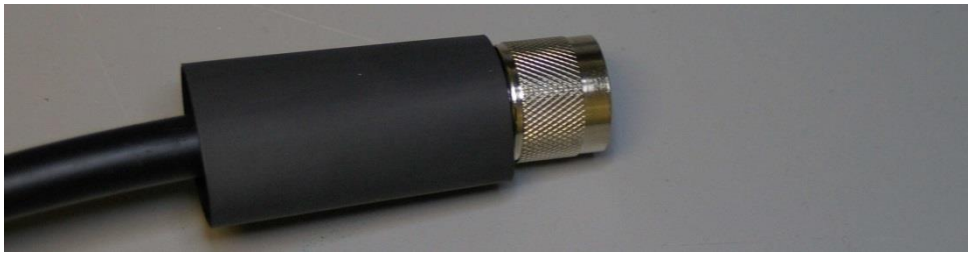
7. Slide crimp collar over braid and trim excess braid carefully.

8. Use the crimp tool to crimp the collar onto the connector, making sure it's as tight to the back of the connector body as possible. Do not crimp rear of crimp collar.





9. Slide the adhesive lined heat shrink onto the back of the connector, applying heat from a heat gun or gas soldering iron to seal.



4.2.7 LMR400 – Times Microwave TC-400-TM TNC male connector

The Times Microwave TC-400-TM connector comes with the following parts:

The termination procedure for the TC-400-NM connector above can be followed, substituting the relevant parts where appropriate.

4.3 INTERFACE AND SERIAL PORT INFORMATION

This details the pin out details for the LD5 receiver connections.

Ports COM 1 to COM 3 on the rear panel are 9 way D-type serial female connectors.

4.3.1 LD5 COM ports

Default configuration for each COM port is:

- 1 start bit
- 8 data bits
- No parity
- 1 stop bit

This information may be required when interfacing to ships systems using RS-232/422 standards. The LD5 is the transmitting device.

DB9 pin	Function	
	RS-232	RS-422
1	Not connected	Not connected
2	TxD	Tx(-)
3	RxD	Rx(-)
4	Not connected	Not connected
5	Signal ground	Signal ground
6	Not connected	Tx(+)
7	Not connected	Not connected
8	Not connected	Not connected
9	Not connected	Rx(+)

5. CONTACT INFORMATION

All initial contacts regarding technical or support issues should be initially addressed to the VERIPOS Helpdesk. Where appropriate, the Helpdesk will refer issues to the regional operations and engineering teams.

5.1 VERIPOS HELPDESK

Helpdesk telephone	+44 (0)1224 965900
Helpdesk e-mail	helpdesk@veripos.com
VERIPOS Online support	http://help.veripos.com

NOTE

If shipping equipment back to VERIPOS, please contact the Helpdesk who will provide the current shipping address, according to the user's area of operations.

5.2 VERIPOS OFFICE LOCATIONS

5.2.1 VERIPOS UK

Veripos House
1B Farburn Terrace
Dyce, Aberdeen
AB21 7DT
Scotland, UK

5.2.2 Additional VERIPOS offices

For up to date locations of other VERIPOS offices worldwide, please visit www.veripos.com.